In the thesis we study a method for determining resonance energies – generalization of the method of analytical continuation in the coupling constant, which is based on continuation of the coupling constant λ as a function of the momentum k. A formula for $\lambda(k)$ is derived for spherically symmetric potential consisting of finite number of δ-functions and its Taylor series is studied. Taylor series of $\lambda(k)$ and its asymptotic behavior is studied for separable potential. Proper choice of added potential parameters is studied on examples. A method for determining $\lambda(k)$ poles is described for spherically symmetric potential with added δ-function. It is tested whether the knowledge of $\lambda(k)$ poles can be useful to improve the accuracy of the determination of the resonance parameters of the original potential.